

Rush Creek Hydroelectrical System,  
Powerhouse Exciters  
(Building No. 101 Exciters)  
Rush Creek  
June Lake Vicinity  
Mono County  
California

HAER No. CA-166-A

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## PHOTOGRAPHS

## WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record  
National Park Service  
Western Region  
Department of the Interior  
San Francisco, California 94107

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## HISTORIC AMERICAN ENGINEERING RECORD

**Rush Creek Hydroelectric System, Powerhouse Exciters**  
(Building No. 101 Exciters)

**HAER No. CA-166-A**

**Rush Creek**  
**June Lake Vicinity**  
**Mono County**  
**California**

**Location:** Near June Lake on the eastern side of the north/south boundary line between Sections 17 and 20, Township 2 South, Range 26 East, M.D.M, Mono County, California (UTM Coordinates 11/313081 /4181858), in the eastern Sierra Nevada Mountain Range about 2.5 miles west of the town of June Lake, California, and 260 air miles due north of Los Angeles.

**Date of Construction:** 1915-1917

**Builder:** General Electric\Pelton-Doble

**Present Owner:** Southern California Edison Company  
2244 Walnut Grove Avenue  
Rosemead, CA 91770

**Original Use:** Exciters

**Present Use:** Exciters

**Significance:** The exciter no. 1 and 2 are original components of the Rush Creek Hydroelectric System power generation equipment. The Rush Creek System is significant under National Register Criteria A and C for its position in the development of hydroelectric generation on the eastern slope of the Sierra Nevada, and its distinctive engineering characteristics. It is an intact example of a high-head, impulse water wheel, high-voltage hydroelectric generation plant. It embodies distinctive innovations in dam construction and powerhouse planning which maximized the plant's production of hydroelectricity..

**Report Prepared By:** Thomas T. Taylor  
Southern California Edison Company  
Environmental Affairs Division  
Rosemead, CA 91770

**Date:** January 15, 1995

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**I. DESCRIPTION**

The Rush Creek Powerhouse is located over 4,000 feet downstream from Agnew Dam at an elevation of 7,230 feet (Map 1). It is a two-story, Mission style industrial structure with a shaped parapet capped by coping on the north and south facades (Photo CA-166-A-1). The structure is 40 feet wide by 80 feet long (97 feet long including the operators cottage), and approximately 63 feet high. It is roofed by corrugated steel supported on iron trusses. A large, rolling metal door provides entry on the north end of the building. Two penstocks enter the west side of the building on the first-floor level (Photo CA-166-A-2). Water exits the structure on the east side through a tailrace which is covered by a wood structure 26 feet wide by 18 feet high and extending about 4 feet out from the main wall (Photo CA-166-A-3; Map 2). A small single story office wing is on the north end of the main structure with doorways on its north and east facades (Williams and Hicks 1989:A-9).

The Rush Creek Powerhouse was originally designed to be a one-story building, but was modified to a two-story structure after construction began as a result of the inability of the owners and the City of Los Angeles to resolve a dispute regarding the city's intention to build a dam on Silver Lake that would cause flooding in the powerhouse building when the lake was at maximum pool. The generator floor was therefore relocated 28 feet above the foundation (SCE Drawing 573421).

The powerhouse contains two electrical generation units. Unit No. 1 consists of a single, Pelton-Doble, 17-bucket, overhung impulse wheel designed to give 8,000 hp at either the 1180-foot net head from Agnew Lake or the 1650-foot net head from Gem Lake. Turning at 300 rpm, it powered a standard 4,400 kw, General Electric ATB 24, three-phase, 60-cycle, 2300-volt, AC generator. Unit No. 2 is also an 8,000 hp single overhung Pelton-Doble wheel but has 19 buckets and is designed to operate only under Gem Lake's 1650-foot head. It turned an Allis Chalmers 4,000 kw, three-phase, 60-cycle, 2300-volt AC generator (Fowler 1923:806; Williams and Hicks 1989:A-14 and A-15).

The generators were served by two exciter sets, each mounted on single bedplates located toward the northwest corner of the powerhouse (SCE Drawing 571329; Photo CA-166-A-4). Exciter No. 1 is a General Electric 60 kw, 125-volt DC generator driven by a small Pelton-Doble impulse wheel (Photos CA-166-A-5, CA-166-A-6, and CA-166-A-7). Its impulse wheel has a hand-controlled gate valve (Photo CA-166-A-8), but the needle is controlled by a Pelton governor. Exciter No. 2 consists of a General Electric DC generator (Photos CA-166-A-9, CA-166-A-10, and CA-166-A-11) driven by a small Pelton-Doble impulse wheel (Photo CA-166-A-12), both duplicates of Exciter No. 1, or a General Electric Type I, three-phase, 90 hp induction motor attached in series to the generator shaft (Photos CA-166-A-13 and CA-166-

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A-14). Exciter No. 2 has a hand-controlled needle and a hand-controlled gate valve (Photo CA-166-A-15) (Fowler 1923:806; Williams and Hicks 1989:A-15).

Water reached the exciter impulse wheels through an 8-inch pipe located below and parallel to the cross-connection. It was supplied by downturns from the outer side of each of the main lines at the main gate valves. Two 2 1/2-inch outlets on the exciter pipe, located near the downturns, supplied water to the motors on each of the governor oil-pressure pumps (Fowler 1923:806; Williams and Hicks 1989:A-15).

The function of an exciter in the generation of alternating current electric power is to provide direct current for the generator rotor windings, or field windings. The exciter maintains generator voltage, controls kilovar flow, assists in maintaining power system stability, and provides important protective functions (Rustebakke 1983:80). The exciter directly affects generator unit reliability and availability by keeping the machine in synchronism with the rest of the electric power system.

## II. HISTORICAL CONTEXT

The Rush Creek Hydroelectric System is significant for its position in the development of hydroelectric generation on the eastern slope of the Sierra Nevada Mountains, and its state and nationally distinctive engineering characteristics. It has been found eligible to the National Register of Historic Places under Criterion A, broad patterns of history, and Criterion C, distinctive characteristics of the type, period, and method of construction that represent the work of a master. The Major theme of the Rush Creek Hydroelectric System is engineering and technological history, and its period of significance is 1915 to 1922. The core components of the system are a primary example of period high-head hydroelectric development with distinctive engineering attributes. A secondary theme of the plant is architecture, which ties it to the larger system of the power company the built it (Williams and Hicks 1989:13).

Like the hydroelectric system constructed on Bishop Creek between 1905 and 1913, hydroelectric developments on Rush Creek and other streams feeding into Mono Lake have their roots in support of mining operations. However, by 1916 when the first unit at Rush Creek went on line, the power generated was directed primarily to the burgeoning Southern California market.

James Stuart Cain and Delos Allen Chappell are the two men most closely associated with development of the Rush Creek Hydroelectric System. In the 1880s, Cain made his fortune in gold mining in the historic boom-town of Bodie, California, and began investing in a wide variety of Mono County businesses--from hanking to mining to power development (Cain

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1956:75-78). As a stockholder of the Standard Consolidated Mining Company, Cain witnessed the delivery of electricity from the Green Creek Power Plant, seven miles above Bridgeport, to the Standard Mill in Bodie in 1893. Sparked by the success of the Green Creek plant, Cain began investigating other sites suitable for hydroelectric development in Mono County. Among the sites he found apropos was Rush Creek above Silver Lake. Between 1903 and 1907, Cain and associates posted notices of appropriation of water rights, surveyed for dam sites, bought-out a competing irrigation company (the California-Nevada Canal, Water and Power Company), and secured federal right-of-ways over public lands to construct irrigation reservoirs and numerous ditches and flumes on Rush Creek (Diamond and Hicks 1988:7 & 8).

After a successful career developing and managing coal mining ventures in Colorado, Delos Allen Chappell sold out his Colorado holdings and moved to California where in 1907 he became president of the Nevada-California Power Company. The Nevada-California Power Company was then in the process of developing power generation on Bishop Creek (about thirty miles south of Rush Creek), and supplying electricity to the mining communities of southwestern Nevada. Chappell soon became aware of the power developments planned for Rush Creek and other streams in the Mono Lake area, and perceived these developments so close to his Company's market as a threat to its existence. Chappell promptly made plans to obtain control of these "outside" interests (Diamond and Hicks 1988:9).

During the period 1907 to 1917, a long series of complicated stock purchases and transfers, incorporations, legal maneuvers, and business transactions occurred which eventually led to the California-Nevada Electric Corporation<sup>1</sup> gaining control of all the Mono Basin hydroelectric projects including Rush Creek. The prime players in this corporate dance were Cain and Chappell, although ironically neither man played a significant role in the construction of the Rush Creek Power Plant. Chappell died in February 1916 after slipping on an icy sidewalk and suffering a compound fracture. Cain, whose interests were eventually obtained in the dealing, lived many more years, but concentrated his efforts on two mining projects in Mono County, neither of which proved successful (Diamond and Hicks 1988:9-12).

In May 1915, the Pacific Power Corporation, controlled by Cain and his associates, began construction of the Rush Creek Power Plant. The plan called for construction of dams at Gem and Agnew lakes, flowlines, penstock, transmission lines (connecting north to other Mono Basin power plants and the Nevada market, and southward to the Bishop Creek plants and the Southern California market), and a powerhouse. Hydroelectric development of Rush Creek

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<sup>1</sup> Incorporated in 1914 as a holding company for Nevada-California Power Company, Southern Sierras Power Company, and a series of other associated entities.

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turned out to be difficult and costly. The nearest railhead was some 60 miles away in Benton. From there, material was hauled to the upper end of Silver Lake by 75 horsepower tractors where a two-section tramway system was constructed to Gem and Agnew lakes. The trams carried men and material to the backcountry construction sites (Diamond and Hicks 1988:13-18).

Construction took place in three stages. The first stage, May to September 1915, consisted of initial clearing and construction work. This stage ended when a dispute with the City of Los Angeles forced a temporary halt in construction.<sup>2</sup> The second stage, May to December 1916, saw construction of the No. 1 flowline, outlet, and powerhouse installed with one 5,000 kv generating unit, and near completion of the Agnew and Gem lakes dams. In the final stage, May to December 1917, the dams were completed, the No. 2 flowline from Gem Lake to the powerhouse was constructed, and a second 5,000 kv generating unit was installed in the powerhouse. More than two years after work began, the Rush Creek Hydroelectric System was completed. It was put into operation 11 December 1917 (Fowler 1923:801).

By the 1917 on-line date, the Rush Creek Hydroelectric System was under the control of the Nevada-California Power Company, a subsidiary of the Nevada-California Electric Corporation, which took over Pacific Power Corporation in May of that year. Rush Creek's 22,330,950 kilowatts contributed significantly to the survival of Nevada-California Electric Corporation in 1917. In that year, output at the Corporation's Bishop Creek System decreased just as electrical demand in Southern California increased (Diamond and Hicks 1988:20-21).

In 1918, Nevada-California Electric Corporation organized its holdings into three main subsidiaries: Nevada-California Power Company, in charge of Nevada business; Southern Sierras Power Company, in charge of Southern California business (except Imperial Valley); and Holton Power Company, in charge of Imperial Valley business. From 1918 to 1922, Nevada-California Power Company operated Rush Creek for the Nevada market. By 1923, Southern Sierras Power Company acquired the Holton Power Company business, took over Rush Creek and other Mono Basin power plants, and directed the power to the more lucrative Southern California-Imperial Valley market (Diamond and Hicks 1988:22).

During this time, improvements to the Rush Creek facility included construction of a new 55-mile transmission tie-line to the Bishop Creek System Control Station, installation of a 3,000

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<sup>2</sup> The City of Los Angeles planned to build a dam on Silver Lake the maximum impound for which would flood the Rush Creek Powerhouse under construction. When negotiations failed to resolve the dispute, Pacific Power Corporation choose to convert the planned one story powerhouse structure into a two story building and raise the height of the generator room floor from 7,226.80 feet to 7,245 (Fowler 1923:805).

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kv, three-phase transformer to operate the line at 88,000 volts, creation of a third reservoir (Rush Meadow) by construction of a new dam, improvements to the Gem and Agnew lake dams and drainage system. The Rush Meadow dam was subsequently raised 15 feet. Additional plans for improvements, including construction of two additional plants, were made but never carried out (Diamond and Hicks 1988:22-25).

During the 1930s, increased competition from rival companies producing cheaper energy on the Colorado River forced the Southern Sierras Power Company to withdraw from the Imperial Valley market. The Nevada-California Electric Corporation, formed as a holding company in 1914 for the companies associated with Southern Sierra Power Company, became an operating company in 1936 when the subsidiary companies were dissolved and the operating properties transferred to the parent company. In 1941, the company changed its name to California Electric Power Company (later known as Calelectric).

The properties of Calelectric were acquired by Southern California Edison Company (SCE) in 1964 through a merger consolidation. SCE is the present operator of the Rush Creek plant. With few modifications Rush Creek has served the electrical generation needs of the Nevada-California Power Company/Southern Sierras Power Company/California Electric Power Company/Southern California Edison Company from 1917 up to the present. Rush Creek (and for that matter, hydroelectric generation in general) contributes an increasingly smaller portion of the Company's total generation mix. Because of its low capacity factor (by modern standards), high relative maintenance costs per kilowatt-hour generation, and comparatively burdensome regulatory operational environment, Rush Creek and other hydroelectric plants of its era face difficult economic times.

### III. SOURCES

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1923 Hydroelectric Power Systems of California and Their Extensions into Oregon and Nevada. Department of the Interior, United States Geological Survey, *Water Supply Paper 493*. Washington, DC: Government Printing Office.

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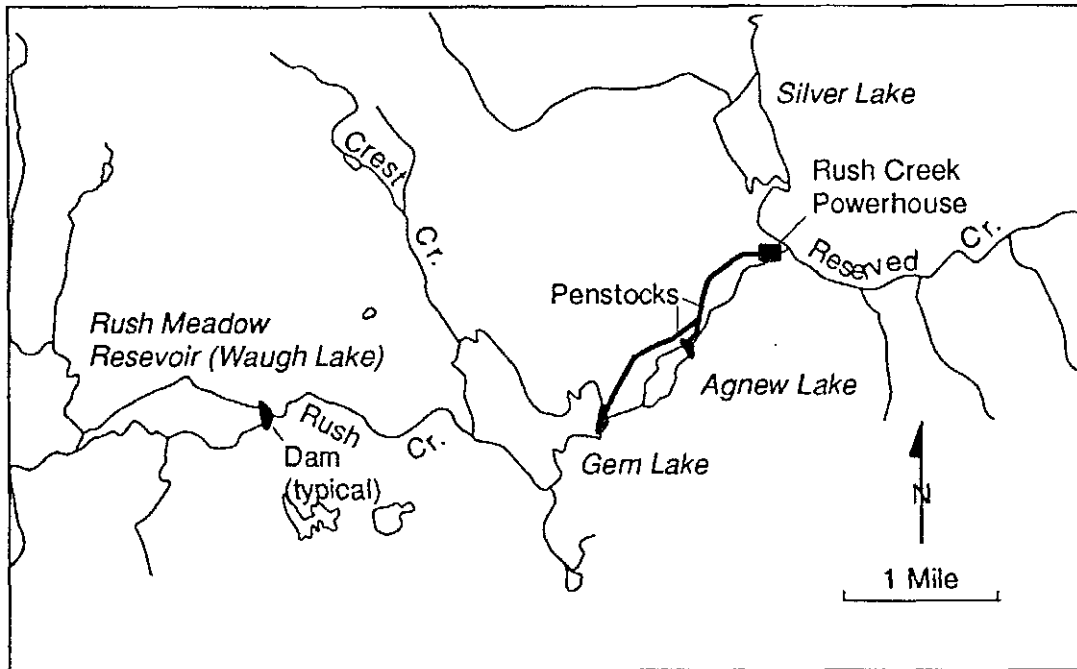
1989 Evaluation of the Historic Resources of the Rush Creek and Lee Vining Creek Hydroelectric System. Report to the Southern California Edison Company. Fair Oaks: Theodoratus Cultural Research, Inc.

#### IV. PROJECT INFORMATION

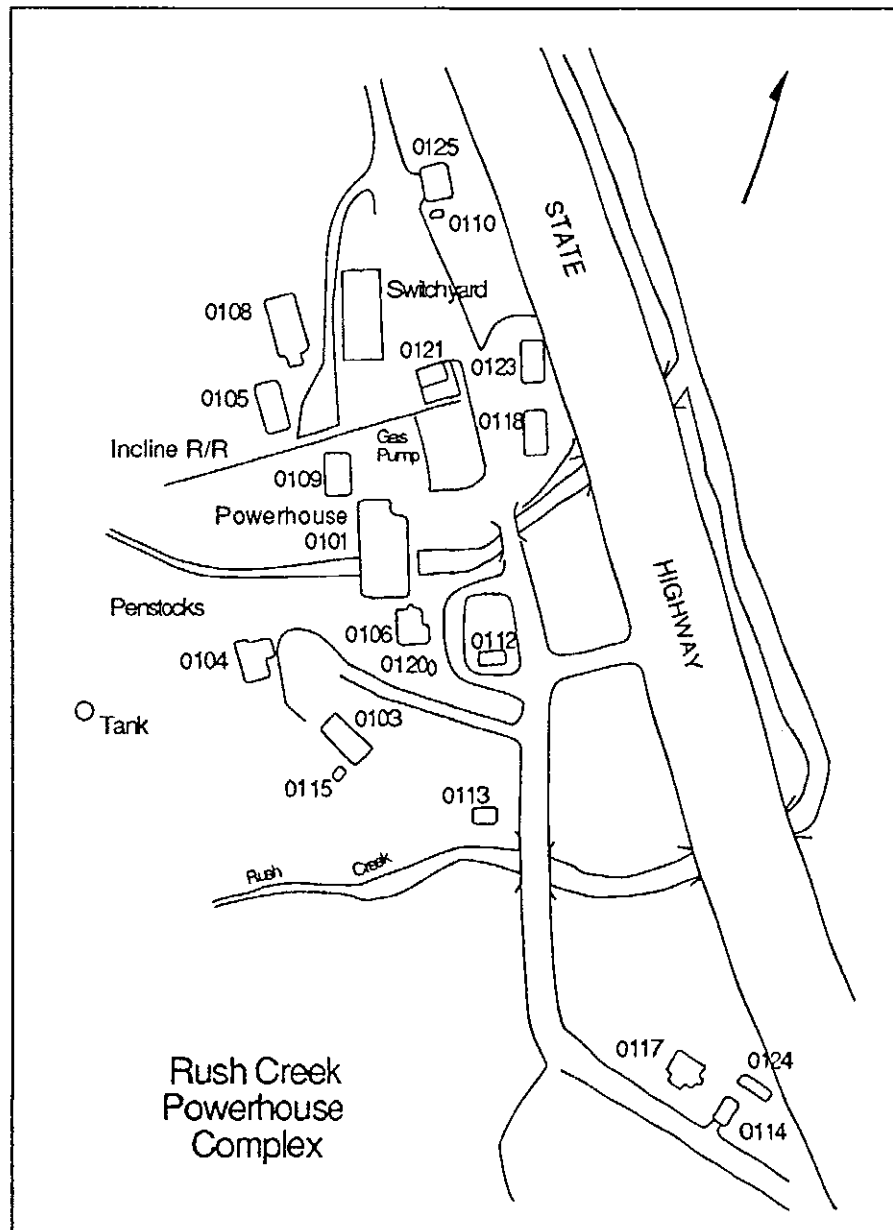
This Historic American Engineering Record documentation of the Rush Creek powerhouse exciters was undertaken because this equipment is obsolete and impedes the efficient synchronization of energy from Rush Creek into the Southern California Edison electric grid. These mechanical exciters are being replaced with digital exciters mounted under the generator floor in the powerhouse building. The project entails removal of the old exciters and covering the floor where they are mounted.



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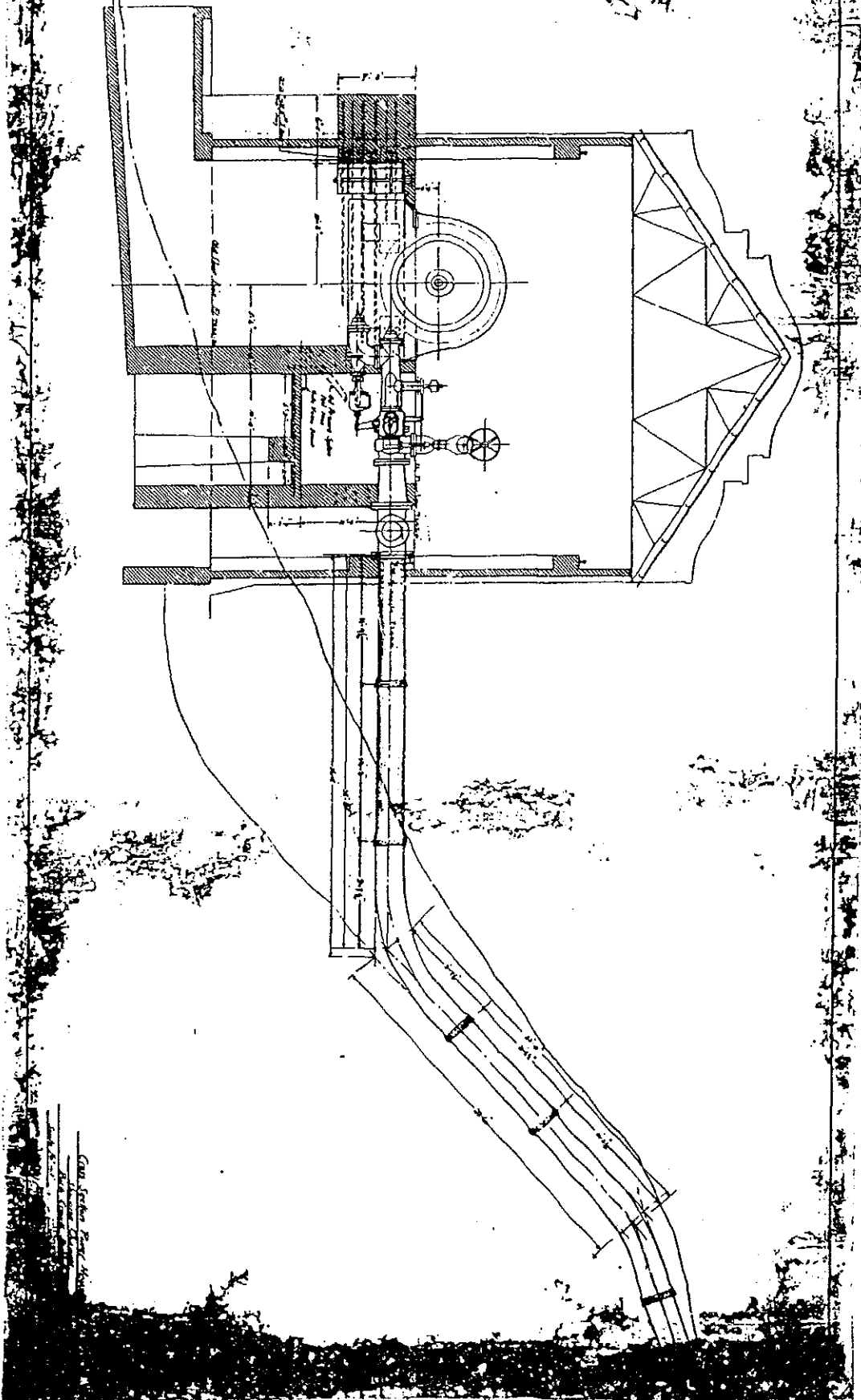


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1. AS-BUILT FOR AUTOMATION

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RUSH CREEK									
CROSS SECTION									
POWERHOUSE									
GENERAL NOTES									
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